
02510 - WATER DISTRIBUTION

(Last revised 4/12/12)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

[Part 1- General](#)

[Part 2 – Products](#)

[Part 3 - Execution](#)

[Air & Vacuum Valve-Spec](#)

[Butterfly Valve-Spec](#)

[Check Valve-Spec](#)

[Detector Check Valve-Spec](#)

[Ductile Iron Pipe - Spec](#)

[DIP-Installation](#)

[DIP Fittings](#)

[DIP Joints](#)

[Fire Hydrant Painting](#)

[Fire Hydrant-Spec](#)

[Fire Hydrants-Setting](#)

[Gate Valves-Spec](#)

[1 ½" & 2" Service-Spec](#)

[Meter Boxes, Small-Spec](#)

[Meter Selection Table](#)

[Parallel Pipe-Clearances](#)

[Pipe Crossing Clearances](#)

[Pipe Separation Req'ts](#)

[Pressure Test & Leakage](#)

[Steel Encas't Pipe-Install](#)

[Steel Encasement Pipe-Spec](#)

[Sterilization](#)

[Small Service Connections-Spec](#)

[Tunneling Method](#)

[Tunnel Liner - Spec](#)

[Tapping Sleeve & Valve-Spec](#)

[Vault Access Frames-Spec](#)

[Valve Boxes-Spec](#)

[PART 1 – GENERAL](#)

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.
- B. Section 02275 – TRENCHING, BACKFILLING & COMPACTION OF UTILITIES.
- C. **VDOT Road & Bridge Specifications**, latest applicable revision

1.2 SUMMARY

This section includes water distribution piping and specialties for municipal water and fire-service mains and services.

1.3 DEFINITIONS

For the purposes of this specification, the following definitions refer to water distribution systems that come under the authority of the City of Fairfax, Virginia as specified within this section and other sections of this manual.

- A. **Utilities Engineer:** The Utilities Engineer or his/her authorized representative.
- B. **Water Main:** Exterior water systems for both domestic water and fire suppression needs.
- C. **Water Service:** Exterior water piping used to provide water for domestic purposes.

The following are industry abbreviation for various pipe materials:

- A. **CI:** Cast Iron Pipe
- B. **DIP:** Ductile Iron Pipe
- C. **RCP:** Reinforced Concrete Pipe
- D. **PVC:** Poly Vinyl Chloride Plastic Pipe
- E. **PCPP:** Prestressed Concrete Pressure Pipe

1.4 SUBMITTALS

- A. Submit product data for the following:
 - 1) Pipe and Fittings
 - 2) Valves and accessories
 - 3) Water meters and accessories
 - 4) Detector Check Valves
 - 5) Backflow preventers and assemblies
 - 6) Fire Hydrants
 - 7) Fire Department Connections
 - 8) Tunneling Shop Drawings, liner plates.
- B. Submit shop drawings for the following in accordance with [Section 01000 – General Requirements](#): Precast Concrete Vaults, including frames and covers, drains, access hatches, wall sleeves, valve support stands.
- C. Upon request, valve manufacturers shall furnish certified copies of test reports.
- D. Any product submitted as an “or approved equal” that is not specifically specified in this specification.

1.5 QUALITY ASSURANCE

- A. Materials and operations shall comply with the latest revision of all applicable Codes and Standards.
- B. Piping materials shall be marked clearly and legibly.
 - 1) Ductile Iron Pipe shall show identification marks on or near bell as follows:
 - a. Weight,
 - b. Class or nominal thickness,
 - c. The letters “DI” or “Ductile,”
 - d. Manufacturer’s identifying mark,
 - e. Year in which pipe was made,
 - f. Casting period.
 - 2) Each length of steel pipe and each special section shall be legibly marked by paint stenciling, die stamping or hot-roll marking to show the following:
 - a. Manufacturer’s name or mark,
 - b. Size and weight of the pipe or special section,
 - c. The type of steel from which the pipe or special section was made.

1.6 STANDARD ABBREVIATIONS

AASHTO	American Association of State Highway Transportation Officials.
ANSI	American National Standards Institute
AREA	American Railway Engineers Association
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
FM	Factory Mutual System
FS	Federal Specifications
MSDS	Material Safety Data Sheets
NSF	National Sanitation Federation International
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories, Inc.
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pipe Conditions/Pipe Examination

- 1) **New Pipe Inspection:** Inspect materials thoroughly upon arrival. Examine materials for damage. Remove damaged or rejected materials from site. Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate ASTM Specifications. Reject any pipe that will not provide watertight seal or is otherwise structurally deficient.
- 2) **Pre-Installation Inspection:** Prior to being installed, each section of the pipe shall be carefully examined for damage and conformity with these specifications. All pipe damaged or deemed not to conform to these specifications shall be rejected and removed from site. All pipe in which the spigots and bells cannot be made to fit properly will be rejected. The faces of all spigots ends and of all shoulders on the bells must be true.

- B. Observe manufacturer's directions for delivery and storage of materials and accessories.

- C. Protect pipe coating during handling using methods recommended by the manufacturer. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.
- D. Prevent damage to pipe during transit. Protect stored piping from entry of water or dirt into pipe. Also, protect bells and flanges of special fittings from entry of moisture and dirt.
- E. Support pipe to prevent sagging or bending.
- F. Use slings to handle valves and fire hydrants if size requires handling by crane or other type of lift. Do not use handwheels or stems to lift or for rigging points.
- G. Store fire hydrants and valves in such a way as to prevent entry of water and dirt into openings. Support off the ground or pavement. If fire hydrants or valves are provided with end protectors, do not remove until ready for installation or for inspection. Once inspected, replace protectors. Protect valves against damage to threaded ends or flanges.

1.8 PRODUCT SUBSTITUTIONS

The Utilities Engineer will approve materials not specified but deemed equal, on a case-by-case basis. Submit documentation and samples of materials. New materials approved for the water distribution system will be incorporated into these specifications after approval.

1.9 PROJECT CONDITIONS

1.9.1 SEPARATION OF WATER AND SANITARY SEWERS

Follow the VDH standards for separation of water mains and sanitary sewers lines.

A. Parallel Installations

- 1) **Normal Conditions** – Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole. The distance shall be measured edge-to-edge.
- 2) **Unusual Conditions** – When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sanitary sewer manhole provided that:
 - a. The bottom (invert) of the water line is at least 18 inches above the top (crown) of the sewer, in which case, a minimum horizontal distance of six (6) feet will be permissible.
 - b. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved Ductile Iron Pipe pressure-tested in place without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

B. Crossing:

- 1) **Normal Conditions** – Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.
 - 2) **Unusual Conditions** – When local conditions prevent a vertical separation described in *Crossing, Normal Conditions*, paragraph above, the following construction shall be used:
 - a. Sewers passing over or under water lines shall be constructed of the materials described in paragraph A *Parallel Installation, Unusual Conditions* – subparagraph 2) b, above.
 - b. Water lines passing under sewers shall, in addition, be protected by providing:
 - i) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.
 - ii) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.
 - iii) That the length of the water line be centered at the point of the crossing so that joints shall be equal distant and as far as possible from the sewer.
- C. **Sanitary sewers or sewer manholes** – No water mains/pipes shall pass through or come in contact with any part of a sewer or sewer manhole.
- D. **Services** – Water services shall maintain a minimum of 6 feet horizontal separation from sanitary sewer laterals.

1.9.2 SEPARATION OF WATER AND OTHER APPURTENANCES

- A. Water mains shall maintain a minimum of 2.5 feet horizontal separation from the edge of gutter pan except at designated crossings.
- B. Water mains shall maintain a minimum of 15 feet horizontal separation from proposed or existing buildings.
- C. **Fire Hydrants and Meter Cocks:** All hydrants and meter cocks shall maintain 5 feet horizontal separation from edge of driveway aprons, when possible.

1.10 COORDINATION

- A. Water valves shall be operated by the Department of Utilities' staff only. Contact the Department of Utilities at 703-385-7920 to coordinate interruption of services and/or operation of valves. After hours, call 703-385-7924. Adequate notifications to water customers will be given by the Contractor prior to any interruption of service. Service is to be continuously maintained to customers in the project areas except for the minimum amount of time required to make connections with the existing system. Only in the case of an emergency may a

valve be closed by a Contractor. Records shall be kept of any valves closed during an emergency and the Department of Utilities shall be notified of the specific valves closed at the earliest reasonable time following such valve closure.

If interruption is necessary, the interruption shall be arranged to occur at such a time to cause the least disruption and minimize loss of service. At the direction of the Utilities Engineer, temporary service may be required to be provided. Before shutting off any main, residents are to be notified by a City of Fairfax representative in writing at least 24 hours in advance of cut off. The Contractor shall provide assistance to the City of Fairfax in notification distribution. The City of Fairfax shall be notified at least 48 hours in advance of request for operation of valves and making either a wet tap or cut-in.

- B. Prior to any water main installations, all required sanitary sewers, including laterals, and storm sewers shall be installed and backfilled to 95% compaction.
- C. Before digging in the ground for any construction, call MISS UTILITY at 1-800-552-7001 to have all underground utilities marked in order to prevent damage or disruption of services. Other utilities that may have potential conflicts are:

Utility	Company	Phone
Electricity	Dominion Virginia Power	1-888-667-3000
Gas	Washington Gas	1-800-752-7520
Phone	Bell Atlantic/Verizon	703-954-6222
Cable TV	Cox Communication	703-378-8422

- D. Prior to any water main installations, all required sanitary sewers, including laterals, and storm sewers shall be installed and backfilled to 95% compaction.
- E. No blasting is permitted within the City Limits and within 50 feet of the City's transmission main in Fairfax and Loudoun Counties.
- F. Permits for Construction on State Highways and Streets: The Virginia Department of Transportation requires a permit for work to be performed on State Highways. Provisions for obtaining such permits are set forth in the "Manual on Permits, Virginia Department of Transportation, Richmond, Virginia," latest revision. No work will be accepted by the Department of Utilities that has not been accepted or approved as satisfactory by the Department of Transportation.
- G. Permits for Construction on City Streets: All permits as required by the City of Fairfax Department of Public Works shall be obtained, and their conditions adhered to, for all work to be performed on City Streets and Rights of Way.
- H. The Contractor shall request a pre-construction meeting and inspection by the City of Fairfax Department of Utilities (703-385-7920) 3 days prior to commencing construction of any water mains.

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 DUCTILE IRON PIPE

A. DUCTILE IRON PIPE

Ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA C151/ ANSI A21.51 for 4-inch and larger diameter pipe, Class 52, minimum (See Design Section) and shall be in 18- or 20-foot lengths. The thickness of Ductile Iron Pipe shall be determined by considering trench load and internal pressure (*the pressure zone and variances in which the pipe will be used*) separately in accordance with AWWA C150/ANSI A21.50. Pipe shall be of the class indicated on the drawings.

The ductile iron pipe shall be cement mortar lined with a seal coat in accordance with AWWA C104/ANSI 21.4. Outside coat shall be a minimum of 1-mil bituminous paint according to AWWA C151/ANSI A21.51 Section 51-8.1. Pipe shall be stamped as required by AWWA C151.

Each joint of ductile iron pipe shall be hydrostatically tested before the outside coating and inside lining are applied at the point of manufacturer to 500 psi. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in production of the pipe are to be tested in accordance with AWWA C151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City of Fairfax upon request. All certified tests, hydrostatic and material are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Push-on and mechanical joint pipe shall be as manufactured by the American Cast Iron Pipe Company, United States Pipe and Foundry Company, Griffin Pipe Products Company, or McWane Cast Iron Pipe Company.

B. DUCTILE IRON JOINTS

Pipe joints may be either mechanical joint or push-on pipe sizes 3 inches through 48 inches. Acceptable types of pipe joints are as follows:

- 1) **Push-on Joint and Ductile Iron Pipe** shall conform to AWWA C151/ANSI A21.51 (such as "Fastite," "Tyton," or "Bell-Tite."). The dimensions of the bell, socket, and plain end shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape to provide an adequate compressive force against the plain end and socket after assembly to affect a positive seal. Gaskets shall be vulcanized natural or vulcanized synthetic rubber, and comply with AWWA C111/ANSI A21.11.
- 2) Mechanical Joint, Ductile Iron Pipe shall be used only at the specific locations indicated on the drawings or as approved by the Utilities Engineer.
 - a. The mechanical joint shall consist of:

- i) A bell cast integrally with the pipe or fitting and provided with an exterior flange having cored or drilled bolt holes and interior annular recesses for the sealing gasket and the spigot of the pipe or fitting;
 - ii) A pipe or fitting spigot;
 - iii) Plain rubber (Styrene Butadiene [SBR]) per AWWA C110/ANSI A21.11 sealing gasket;
 - iv) Separate ductile iron follower gland having cored or drilled bolt holes; and
 - v) Alloy steel Tee Head bolts and hexagon nuts. All threads are Coarse-Thread Series Class 2A, External and Class 2B, Internal, per ANSI B1.1. Nuts to be furnished in accordance with ASTM A563, *Standard Specification for Carbon and Alloy Steel Nuts*.
- b. The joint shall be designed to permit normal expansion, contraction, and deflection of the pipe or fitting while maintaining a leak proof joint connection. The mechanical joint shall conform to the requirements of Federal Specification WW-P-421, AWWA C111/ANSI A21.11, and ASTM A 536 Standard Specification of Ductile Iron Castings.
- c. Mechanical Joint Bolt Torque

See section [3.1.1 below, paragraph A](#), item a, *Installing Mechanical Joint Pipe*.

- 3) **Restrained Joints:** Acceptable types of restrained joints shall be:
- a. MEGALUG joint restraint system, using MEGALUG series 1100 mechanical joint restraint by Ebba Iron Sales, Inc, Ford wedge action restrainer gland UFR Series 1400, or approved equal. Bolt heads are to be “auto-torque” twist off. See **Standard Detail 512.03**, sheet 2 of 2.
 - b. TR Flex as manufactured by U. S. Pipe and Foundry Company, Flex Ring as manufactured by American Ductile Iron Pipe Company, Snap Lok as manufactured by Griffin Pipe Products Company, or approved equal.
- 4) **Flanged Joints** shall be firmly bolted with machine bolts; however, where valves or specialties are attached to a flange pipe, stud or tap bolts may be used, providing the number used and diameter for each joint is the same for each respective size of pipe, specialty, or valve, as recommended by the latest AWWA Standard for flanged drilling. Bolts are specified in ANSI B18.2.1 and nuts are specified in ANSI B18.2.2. All bolts and nuts shall be grade 9 and of sufficient length to pass through two flanges. Bolts shall be of sufficient length to pass through two flanges and the nut threads shall be accurately cut, close fitting, and the prevailing standard. Bolt heads shall be cut square and nuts hexagon in shape, both the heads and nuts being chamfered. Gaskets to be of 1/8-inch thick plain rubber (Styrene Butadiene [SBR]) per AWWA C110/ANSI A21.11 or equal as approved by the Utilities Engineer.

C. DUCTILE IRON FITTINGS

Fittings shall be ductile iron, grade 70-50-05, at least class 54 thickness, and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI 21.53 for compact fittings, pipe sizes 3 inches through 48 inches. All ductile iron fittings shall have a minimum working pressure rating of 350 psi and shall be cement mortar lined and bituminous coated in accordance with AWWA C104/ANSI A 21.4. The fittings shall be tested and the manufacturer shall provide certified test result when requested by the City of Fairfax. This testing shall include hydrostatic proof testing of fittings. Glands, gaskets, and bolts shall conform to AWWA C111/ANSI A 21.11. The use of push-on fittings is not permitted. Acceptable manufacturers are: American Cast Iron Pipe Company, U. S. Pipe & Foundry Company, or Griffin Pipe Company. Acceptable types of fittings are:

- 1) **Full Body Mechanical Joint Fittings:** Full body ductile iron mechanical joint fittings shall be minimum class 250 and shall conform to AWWA C110/ANSI A21.10. Glands, Gaskets and Bolts shall conform to AWWA C111/ANSI A21.11.
- 2) **Mechanical Joint Fittings – Compact:** Compact fittings shall be minimum class 350 and shall comply with AWWA C 153/ANSI A21.53, pipe sizes 4 inches through 48 inches. Glands, Gaskets and Bolts shall conform to AWWA C111/ANSI A21.11.
- 3) **Mechanical Joint Restraints:** Joint restraints shall consist of the use of a Megalug joint restraint system using Megalug series 1100 mechanical joint restraint by EBAA Iron Sales, Inc., Ford wedge action restrainer gland UFR Series 1400, or approved equal. Bolt heads are to be “auto-torque” twist off. See [Standard Detail 512.03](#), sheet 2 of 2.

When restrained joints are specified, they shall be Megalug series 1100 mechanical joint restraint by EBAA Iron Sales, Inc. or approved equal. See [Standard Detail 512.03](#), sheet 2 of 2 for figure of Megalug.

2.1.2 PRESTRESSED CONCRETE PRESSURE PIPE (PCPP)

- A. For water transmission mains larger than 16 inches in inner diameter and larger, cylinder type Prestressed Concrete Pressure Pipe may be used in lieu of ductile iron pipe as approved by the Utilities Engineer.
 - 1) All Prestressed concrete pressure pipes shall be manufactured and delivered in accordance with current AWWA Standard C301, *AWWA Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type* and AWWA Standard C304, *AWWA Standard for Design of Prestressed Concrete Cylinder Pipe*. Design calculations for this specification shall be submitted for approval prior to manufacture of pipe. Pipe class to be at least equal to the pipe being replaced.

Design and manufacture in accordance with the following AWWA C301 and C304 to meet the following minimum conditions:

- 1) Internal pressure: 150 psi
- 2) Earth Loads: actual trench depth, but not less than 6 feet.

- 3) Live Loads: HS 20 vehicle over trench
- 4) Surge Pressure: allowance of 60 psi
- 5) Bedding: Type R2, AWWA C304, Figure 9
- 6) Safety Factor: 2.5

The design aforementioned shall be considered as part of the requirement of the current AWWA C301, Sec. 1.5.

The pipe shall be made by a manufacturer experienced in producing pipe for the type, size, and quality herein specified with a record of at least 5 years successful performance in use in projects of a considerable magnitude in the United States.

Wherever adapters are required to properly connect the PCPP with existing pipe of other material or manufacture, the nominal ID of adapters shall be the same size as the nominal diameter of pipe connected thereto. Adapters shall also be furnished and used as required by the manufacturer for connection to fittings, valves, and hydrants.

- B. **Tapping Outlet:** A tapping outlet shall be provided for each existing commercial and/or residential building and elsewhere at locations and of such sizes as shown on the plans.

The outlet shall be construed in accordance with the detail shown on the plans and installed in accordance with the pipe manufacturers specifications.

2.1.3 COPPER TUBE SERVICE PIPE

Copper pipe shall meet ASTM B88 *Standard Specification for Seamless Copper Water Tube*, Type K, water tube annealed temper soft drawn for use with flare type (brass) fittings for ¾-inch and 2-inch below ground services.

2.1.4 STEEL CASING PIPE

- A. **Steel Pipe for Encasement and Boring Applications:**

Steel pipe for encasement and boring applications shall meet the requirements of AWWA C200, *AWWA Standard for mill type steel water pipe*. Nominal pipe diameter and wall thickness shall be as indicated on the drawings. Pipe shall be high strength steel, spiral welded or smooth-wall seamless manufactured in accordance with ASTM A139, *Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)* and ASTM A283/A283M, *Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates*, Grade "B" steel with a minimum yield strength of 35,000 psi. All encasement pipes shall meet the applicable VDOT, and AREA specifications but shall be no less than 6 inches larger than the outside diameter of the carrier pipe bell. The steel pipe shall be capable of withstanding the design load. No interior lining and exterior coating shall be required except that all exposed metal is to be coated with epoxy or asphaltic material. The pipe shall have welded joints and be in at least 18-foot lengths. Casing pipe shall include pipe carriers (Spiders) to support carrier pipe. The steel encasement pipe shall be of leak proof construction and shall include end caps.

- B. **Spiders/Skids for Encasement Pipes:** Prefabricated stainless steel pipe supports with non-conductive skids or other acceptable support system shall be provide to support the pipe. Pressure treated skids will not be permitted. Acceptable manufacturers are: Advanced Products & Systems (APS) model SSI with EPDM skids, Lafayette, LA, or approved equal. For bolted connections, bolts shall be either galvanized or stainless steel.
- C. **Steel Casing End Seals:** Casing end seals shall be 1/8" thick synthetic rubber seamless pull-on end seals with T-304 stainless steel banding with 100% non-magnetic worm gear mechanism. End seals shall permit pipe movement while maintaining a seal. Acceptable manufacturers are: Advance Products & Systems, Inc., Lafayette, LA, or equal.

2.1.5 TUNNEL LINERS AND APPURTENANCES

- A. Grout mix for filling voids in between carrier pipe and tunnel shall consist of the following materials properly mixed in proportions by weight.
 - 1) 1.0 Part Cement,
 - 2) 3.0 Parts Fine Sand, 100 Percent Shall Pass No. 16 Sieve, and
 - 3) 0.5 to 0.6 Part Water.
- B. Tunnel lining construction shall comply with the "*Specification for Steel Tunnel Liner Plates*" in the AREA Manual for Railway Engineering. The design and shape of the liner plates shall be such that erection and assembly of the liner plate structure can be completely and readily effected from inside the tunnel. Plates shall be accurately curved to suit the tunnel cross section, and all dimensions shall be of the size and accuracy that plates of similar curvature shall be interchangeable. All plates shall be connected by bolts on both longitudinal and circumferential joints.
- C. The steel lining shall consist of plates 16, 18, or 24 inches wide. Each circumferential ring shall be composed of the number and length plates necessary to complete the required shape shown on the drawings. The nominal tunnel diameter shall be of sufficient size to install the carrier pipe.
- D. Plates shall be one-piece steel meeting the requirements of ASTM A 569, ASTM A 570, and ASTM A 611. Plates shall have an ultimate tensile strength of at least 42,000 psi and yield strength of 28,000 psi. Gage thickness shall be a minimum of 8 gage. The liner plate and bolts shall be galvanized in accordance with ASTM A153. The liner plates shall be asphalt coated to meet AREA 1-14-13. For two flange plates, the minimum thickness shall be 0.135 inches. Plates shall be manufactured by Armco Steel Corporation, Commercial Shearing, Incorporated, Republic Steel Corporation, or approved equal.
- E. Grout holes 1½ inches or 2 inches (or larger) in diameter shall be provided in each ring to permit grouting as the erection of the tunnel liner plates progresses. Grout hole screw plugs shall be provided in plates.
- F. Steel bolts shall meet requirements of ASTM A449 for plate thickness equal to or greater than 0.209 inch and ASTM A 307 for plate thickness less than 0.209 inch. The nut shall meet requirements of ASTM A 307, Grade A.

2.1.6 CARRIER PIPE FOR CASINGS AND TUNNELS

Carrier pipe shall be mechanical joint ductile iron pipe of the class indicated on the drawings with the minimum being Class 52 with restrained joints.

2.2 VALVES AND FIRE HYDRANTS

2.2.1 GATE VALVES, RESILIENT WEDGE (2 INCH THRU 12-INCH)

All gate valves shall be of the resilient wedge type complying with AWWA C509, *AWWA Standard for Resilient-Seated Gate Valves for Water Supply Service* and shall be UL listed and FM approved for a working pressure of 200 psi. All internal parts shall be accessible without removing the body from the line. The wedge shall be of cast iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber tearing bond to meet ASTM D429 *Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates* and AWWA C550, *AWWA Standard for Protective Epoxy Interior Coatings for Valves and Hydrants*.

Non-Rising Stems (NRS) stems shall be cast bronze with integral collars in compliance with AWWA. Outside Screw and Yoke (OS&Y) stems shall be bronze. The NRS stuffing box shall have two "O"-Ring seals above the thrust collar. These rings shall be field replaceable without removing the valve from service.

Each valve shall be hydrostatically tested at 400 PSI to the requirements of both AWWA and UL/FM.

All gate valves shall be of the mechanical joint type.

Valves shall open counter-clockwise (left) and shall be equipped with a 2-inch square AWWA operating nut.

- A. Valves over 16-inch shall be rubber seated butterfly type, as specified in [paragraph 2.2.4, Butterfly Valves](#).
- B. Geared operation shall be provided for gate valves rated for 250 psi or more and for all gate valves 16 inches in size or larger.
- C. Gate Valve sizes 2 inches through 16 inches shall be as manufactured by Mueller, or Kennedy.
- D. Approved Gate Valves are listed below:

Model	Manufacturer
A-2360-20	Mueller
Kenseal II	Kennedy

- E. **Inserting Valves:** Inserting valves shall meet requirements of gate valves specified above for valve mechanism and AWWA C110/ANSI A21.10 for the sleeve for a working pressure of 200 psi, with specifically designed mechanical joint ends. Valves shall be Mueller Model H-842, or approved equal.

- F. **Gate valves smaller than 4 inches** shall be resilient seat, solid wedge, inside screw, non-rising stem, bolted bonnet, stainless steel bolts, and threaded ends. All valves shall be furnished with a 2-inch operator nut and open left. Acceptable gate valves are:

Model	Manufacturer
H-2360-8	Mueller
Kenseal II	Kennedy

2.2.2 AIR RELEASE VALVE

1-inch or 2-inch inlet air release valves shall be APCO Air Release Valve #200-A, with concave float, or approved equal (see [Standard Detail 513.04](#)). Size and location shall be indicated on drawings. Valves shall be rated for working and corresponding test pressure as indicated on the drawings. These valves shall be suitable for a minimum 200-psi working pressure but shall be no less than the working pressure indicated on the drawings. The valves are to be designed to allow air to escape automatically while the main is in service and under pressure. The valves are to relieve large volumes of air as the lines are filled or emptied and also release small quantities of entrained air under pressure.

2.2.3 CHECK VALVES

All swing check valves shall be iron body; with a disc of extra heavy cast iron, ASTM A126 *Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings* construction, bronze mounted with either mechanical joint or flanged ends as noted on the drawings. Standard mechanical joint ends shall be furnished with bolts, glands, and rubber gaskets. Flanged ends shall be provided with bolts and gaskets. The shaft shall be of 304 stainless steel and the seat ring shall be of bronze with an easily replaceable resilient disc seat.

Check valves shall be gravity operation unless otherwise noted on the drawings. Valves 2 ½ inches to 14 inches shall be designed for a 175-psi working pressure and shall have a minimum test pressure of 350 psi.

Flanged check valves shall meet the dimensional requirement of ANSI B16.1 and meet or exceed the requirements of AWWA C-508, *AWWA Standard for Swing-check Valves for Water works Service, 2-inch through 24 inch*. The valve shall be tight seating and furnished with an easily replaceable resilient seat.

When more positive control is needed, either lever-and-spring or lever-and-weight may be specified.

All check valves shall be furnished with an arrow cast into the body indicating the direction of flow during system operation.

Approved check valves are the Mueller A-2600 Series or the Kennedy Swing Check Valve.

2.2.4 BUTTERFLY VALVES

Butterfly valves, for valve applications larger than 16 inches, shall meet AWWA C504, *AWWA Standard for Rubber-Seated Butterfly Valves*. Valves shall be rated for the pressure class or classes indicated on the drawings.

Valves shall be mechanical joint in accordance with AWWA C111. Accessories (bolts, glands, and gaskets) shall be supplied by the valve manufacturer.

Valve operators shall meet the requirements of AWWA C504 and shall be of the traveling-nut type, sealed, gasketed, and lubricated for direct-bury underground service. Valve operators shall be sized for the pressure indicated on the drawings. Operator shall be capable of withstanding an input torque of 450 ft-lbs at full open or closed position, without damage to the valve or valve operators. Butterfly valve manufacturers shall be Mueller Company, Kennedy, or approved equal.

Valves shall open counter-clockwise (left) and shall be equipped with a 2-inch square AWWA operating nut.

Valves shall be factory tested in accordance with Section 5 of AWWA C504 specification. Upon request the manufacturer shall furnish certified copies of test reports.

2.2.5 TAPPING SLEEVES AND VALVES

- A. **Iron Body Tapping Sleeve:** The sleeve body shall be of split type, full body ductile iron construction with mechanical joint ends and epoxy coating (10-mil minimum) and a brass test plug. The sleeve shall be suitable to fit the type and class of pipe being tapped. The mechanical joint type shall have longitudinal compound rubber gaskets that fit against the rubber end gaskets effecting a totally enclosed rubber, watertight seal. Side and end bolts shall be stainless steel. Tapping sleeve shall meet the requirements of AWWA C110/ANSI 21.10. See [Standard Detail 513.03](#).

Acceptable resilient seat tapping sleeves are listed below:

Manufacturer	Model
American Flow Control	2800-C for CI to PVC
Mueller	H-615 for CI to PVC
Tyler/Union	For DIP to DIP

- B. **Tapping Valves:** Tapping valves shall meet the requirements of Gate Valves as specified above in Part 2 - PRODUCTS, [Gate Valves, paragraph 2.2.1](#) except that the seat openings shall be larger than nominal size and valve ends shall be mechanical joint and the inlet end shall have a Class 125 flange for attending sleeve.

Tapping valves shall be "O" ring type with mechanical joint and conforming to AWWA non-rising stem construction. Inlet flange end shall be Class 125 (ANSI B16.1).

Approved tapping valves are listed below:

Model	Manufacturer
T-2360 (2- thru 12-inch)	Mueller
T-2361 (14- through 24 inch)	
Kenseal II	Kennedy

2.2.6 FIRE HYDRANTS

- A. See [Standard Details 514.01](#), [514.02](#), and [514.03](#). Traffic model fire hydrants shall comply with AWWA C502, *AWWA Standard for Dry-Barrel Fire Hydrants*, latest revision, UL 246 and FM1510. Approved fire hydrants including model and manufacturer are listed below:

Table 25.1			
Model	Manufacturer	Pressure Zone	
		Std	High Press
Guardian	Kennedy	X	
A-423 Super Centurion 250	Mueller	X	X

- B. Interior coating to be in accordance with AWWA C550, *AWWA Standard for Protective Epoxy Interior Coatings for Valves and Hydrants*. Minimum working pressure shall be 150 psi except use 250 working pressure in high-pressure zones. Nozzles shall have National Standard threads. Hydrants shall consist of the following:
- 1) Two 2½ -inch fire nozzles and one 4½ -inch pumper connection.
 - 2) All nozzles shall be provided with caps and cap retaining chains securely chained to the barrel of the hydrant. The nozzle caps shall be provided with a gasket to ensure a tight seal with the nozzles. Cap nuts shall have the same dimensions as the operating nut of the hydrant.
 - 3) The hydrant valve opening shall be 5¼ inches.
 - 4) Bronze to bronze threads shall be provided between the hydrant seat or seat ring and the seating attaching assembly.
 - 5) All hydrants must include cast or ductile epoxy lined shoe, rubber drain seals and positive protective valve stop device.
 - 6) Hydrants shall open left (counterclockwise) and shall have a 6-inch mechanical joint elbow.
 - 7) The hydrant barrel shall be of sufficient length to provide a minimum bury of 3 feet.
 - 8) Hydrants shall be of the compression type closing with line pressure and shall be of the traffic model breakaway type.
 - 9) Hydrant cap and stuffing box shall be of unitized, one-piece design creating a watertight cavity without the use of gaskets. The combination of O-Rings to a crimped brass ferrule around the stem shall seal the cavity from contact with water. Hydrant caps shall have a means for providing periodic lubrication of the operating threads.
 - 10) The operating nut shall be of one-piece bronze construction. A thrust washer shall be supplied between the operating nut and stem lock nut.
 - 11) The main valve shall be of synthetic rubber reinforced with steel. The seat shall be of a bronze ring threaded to a bronze insert in the hydrant shoe, with O-Rings to seal the drain way and barrel from leakage of water in the shoe.
 - 12) The hydrant drain hole shall momentarily force flush with each operation.

- 13) Hydrant is to be painted with Sherwin William (or approved equal) paint with at least 2 coats of Safety Red (B54 R38 617-4064) from the bonnet down and the bonnet with Pure White (B54 W101 7907-99993). Fire Hydrants with a working pressure greater than 100 psi shall have the 2½ -inch connection caps painted black gloss.
- 14) If line is to be pressurized within 7 days, then high early strength concrete shall be used.
- 15) The bonnet shall be equipped with the Department of Utilities approved reflective information ring.

2.2.7 CORPORATION STOPS, ANGLE VALVES, AND CURB STOPS

Corporation stops, angle valves, and curb stops shall be ball-type as manufactured by Ford or Mueller.

2.2.8 BACKFLOW PREVENTERS

- A. **Detector Check Valves:** Heavy Duty Detector check valves shall be furnished and shall conform to the requirements of these specifications, working pressure 175-psi minimum. Heavy Duty Detector check valves shall be listed by Underwriters Laboratories, Inc. and approved by Associated Factory Mutual. Detector check valves shall be installed in the horizontal position with an arrow pointing in the direction of flow. The by-pass meter may be trimmed either right or left. A meter trim package shall be furnished containing all nipples, bushings, elbows and related fittings needed to construct by-pass line. A bypass meter shall be installed meeting the specifications of the City.

Detector check valves shall have flanged ends having the exterior either factory finished with red paint or hot dipped galvanized.

Flanged ends shall comply with the dimensional requirements of ANSI B16.1.

The clapper is to be rubber-faced with nylon pivot bushings.

The valve body is to have an external arrow cast into the body indicating the direction of flow during system operation.

Provide bolted cover with air-bleed device for access to internal parts. Include threaded bypass taps in inlet and outlet for bypass meter connection.

Set valve to allow minimal water flow though bypass meter when major flow is required.

Approved double detector check valves are the Hersey DDC2, Ames 3000SS, Watts 709, or approved equal. The Utilities Engineer may approve additional devices/manufacturers/models. All detector check valve enclosures (box or vault) must be reviewed by the Utilities Engineer.

B. RPZ (Reduced Pressure Principle) Backflow Preventers

1) 3/4" to 2" RPZ Backflow Preventers:

RPZ Backflow preventers are to be unique patented design of air-in/water-out principle high capacity relief valve discharge during the emergency

conditions of combined backsiphonage and backpressure with both checks fouled meeting.

The reduced pressure backflow preventer shall consist of two independently operating, spring loaded, “Y” pattern check valves, and one hydraulically dependent differential relief valve. In a nonflow condition, check valves are closed with pressure between the checks, called the zone, being maintained at least 5 PSI lower than the inlet pressure and the relief valve is maintained closed. If the differential between the zone and the upstream pressure drops to 2 PSI, the differential relief valve will open, maintaining proper zone differential.

Valve body and caps including relief valve body and cover shall be bronze. Check valve moving members shall be center stem guided. All hydraulic sensing passages shall be internally located within the mainline and relief valve bodies and relief valve cover. Diaphragm to seat area ratio shall be 10:1 minimum. Relief valve shall have a removable seat ring. Check valve and relief valve components shall be constructed so they may be serviced without removing the valve body from the line. All seat discs shall be reversible. Shut-off and testcocks shall be full ported ball valves.

The assembly shall be rated to 175-psi water working pressure and water temperature range from 32°F to 140°F.

The assembly shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C511.89; CSA Standard B64.4; and approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California, UL Listed and FM approved

Approved RPZ backflow preventers are the Watts 709 (3/4-inch through 10-inch). The Utilities Engineer may approve additional devices/manufacturers/models. All detector check valve enclosures (box or vault) must be placed above ground and shall be reviewed by the Utilities Engineer.

2) **2 ½” to 10” RPZ Backflow Preventers:**

RPZ Backflow preventers are to be unique patented design of air-in/water-out principle high capacity relief valve discharge during the emergency conditions of combined backsiphonage and backpressure with both checks fouled meeting.

Operation: In a nonflow condition, check valves on the by-pass and mainline units are closed with pressure between the checks, called the zone, being maintained at least 5 PSI lower than the inlet pressure and the relief valve is maintained closed. If the differential between the zone and the upstream pressure drops to 2 PSI, the differential relief valve will open, maintaining proper zone differential. The by-pass reduced pressure backflow preventer will operate identically to the mainline assembly.

By-pass: The by-pass opens to detect initial flow and the mainline opens for all other flows.

Mainline RPZ is to be flanged, ANSI B 16.1, Class 125, heavy valve bodies manufactured of ductile iron ASTM A536, Grade 65-45-12 with bronze seats, internal and external fusion epoxy coating, epoxy coated cast iron relief valve with stainless steel trim and with bronze body ball valve test cocks in parallel with a reduced pressure by-pass assembly. RPZ's are to be furnished with OS&Y gate valve shutoffs. RPZ backflow preventers shall be furnished and shall conform to the requirements of these specifications suitable for supply pressures of 175-psi and water temperatures of 110°F.

All low flow demands up to a minimum of 3 GPM are to pass only through the by-pass meter and meter-size reduced pressure assembly and be accurately recorded. All flows above that of 3 GPM will pass through both the line-size reduced pressure assembly and by-pass with out accurate registration by or damage to the meter. Shut off valves and testcocks shall be resilient seats with full flow characteristics and are to be considered integral to the assembly. The mainline shut-offs are to OS&Y, UL/FM for fireline service.

Reduced pressure detector assemblies are to be factory assembled and tested to assure proper mainline/by-pass balance and cross over performance.

RPZ's are to be approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California, UL Listed and FM approved.

RPZ's shall be installed in the horizontal position with an arrow pointing in the direction of flow. The by-pass meter may be trimmed either right or left. A meter trim package shall be furnished containing all nipples, bushings, elbows and related fittings needed to construct by-pass line. A meter shall be installed meeting the specifications of the City of Fairfax as noted elsewhere in these specifications.

RPZ's shall have flanged ends having the exterior either factory finished with red paint or hot dipped galvanized. Flanged ends shall comply with the dimensional requirements of ANSI B16.1, Class 125.

Provide bolted cover with air-bleed device for access to internal parts. Include threaded bypass taps in inlet and outlet for bypass meter connection.

The assembly shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C511.89; CSA Standard B64.4; and approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California, UL Listed and FM approved.

- 3) **Approved Models:** Approved RPZ backflow preventers are the Watts 909 (3/4-inch through 10-inch). The Utilities Engineer may approve additional devices/manufacturers/models. All RPZ enclosures (box or vault) must be placed above ground and shall be reviewed by the Utilities Engineer.

2.3 MISCELLANEOUS APPURTENANCES

2.3.1 FLANGED ADAPTER

- A. Utilize where noted on drawings to all for ease of dismantling piping in the future.
- B. Body: Ductile iron conforming to the requirements of ASTM A536.
- C. End Rings (Follower Rings): Ductile iron conforming to the requirements of ASTM A536.
- D. Gaskets: SBR per ASTM D2000 new rubber compounded for water service and resistant to permanent set.
- E. Bolts and Nuts: High strength, low alloy corrosion resistant steel per AWWA C111 or Ductile Iron per ASTM A536, or carbon steel bolts conforming to the requirements of ASTM A307.

2.3.2 CAST STRAIGHT AND TRANSITION FLEXIBLE PIPE COUPLINGS

- A. Utilize where noted on drawings to all for ease of dismantling piping in the future. Couplings shall be of a gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two rubber compounded wedge section gaskets, and sufficient track head stainless steel bolts to properly compress the gaskets.
 - 1) Center Sleeve (Center Ring): Ductile Iron per ASTM A536, steel pipe or tubing conforming to the requirements of A53, A512; or formed carbon steel with a minimum yield of 30,000 psi.
 - 2) End Rings (Follower Rings): Ductile iron conforming to the requirements of ASTM A536, or steel meeting or exceeding the requirements of A576, grade 1010-1020.
 - 3) Gaskets: SBR rubber per ASTM D2000 new rubber compounded for water service and resistant to permanent set.
 - 4) Bolts and Nuts: High strength, low allow per ASTM A242 and AWWA C111 or corrosion resistant stainless steel.

Couplings shall be of the type to match piping on which installed. Couplings shall be Smith-Blair Type 441 and 461, Ford FC-1 and FC-2A, JCM 212, 215 and 216 models, and Romac 501.

2.3.3 MISCELLANEOUS CONCRETE

Concrete Classes (VDOT) to Design Compressive Strength at 28 days (f'c):

Class A4.5	General	4,500-psi
Class A4	General	4,000-psi
Class A3	General	3,000-psi
Class B2	Massive or Lightly Reinforced	2,200-psi

Ready mixed concrete shall comply with ASTM C94, *Standard Specification for Ready-Mixed Concrete*. All exposed concrete shall be air entrained. Concrete strength shall be as specified on standard details and drawings. Unless otherwise specified, all concrete shall be Class A3, minimum.

2.3.4 PORTLAND CEMENT

Type I, CSA normal, ASTM C150 *Standard Specifications for Portland Cement*.

2.3.5 BEDDING: See [Section 02275 – Trenching, Backfilling, and Compaction of Utilities](#).

2.3.6 PRECAST CONCRETE MANHOLE STRUCTURES

Structures of precast reinforced concrete manholes shall be designed and manufactured in accordance with ASTM C478, *Standard Specification for Precast Reinforced Concrete Manhole Sections*, latest revision (“O” ring joints), or AASHTO M-199 (gasketed joints). The standard joint shall be sealed with plastic cement putty meeting Federal Specification SS-C-153. An “O” ring or “mastic” joint seal may be used. The “O” ring joint shall conform to the requirements of ASTM C443 *Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets*. Type Concrete used in the construction of the manholes shall have a minimum 28-day compressive strength of 4000-psi air entrained (with 4 to 6 percent air) conforming to ASTM C33 *Standard Specification for Concrete Aggregates* and ASTM C94 *Standard Specification for Ready-Mixed Concrete*. Manholes shall have monolithic base and eccentric cone flat top as applicable. See [Standard Detail 513.04](#). Structures are not permitted to have steps. Acceptable manufacturers are: Carolina Precast Concrete, Inc., Oldcastle Precast, or Tindall Precast Concrete Products, Inc.

Unless shown otherwise, the minimum diameter of manholes shall be 5 feet.

2.3.7 PRECAST UNDERGROUND CONCRETE UTILITY STRUCTURES

Structures of precast reinforced concrete shall be designed and manufactured in accordance with ASTM C858, *Standard Specification for Underground Precast Concrete Utility Structures*, latest revision with preformed butyl rubber joint sealant meeting ASTM C990, *Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed flexible Joint Sealants*, latest revision. Type Concrete used in the construction of the Utility Structures shall have a minimum 28-day compressive strength of 4000-psi air entrained (with 4 to 6 percent air) conforming to ASTM C33 *Standard Specification for Concrete Aggregates* and ASTM C94 *Standard Specification for Ready-Mixed Concrete*. Unless shown otherwise on the drawings, structures are not to have steps. Steel reinforcing shall conform to the requirements of ASTM C857, *Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures*, latest revision. Structures shall be designed for an H20-44 loading in traffic areas. Acceptable manufacturers are: Carolina Precast Concrete, Inc., Oldcastle Precast, or Tindall Precast Concrete Products, Inc.

2.3.8 MANHOLE FRAME AND COVERS

- A. **Standard Frames and Covers:** Manhole frames and covers shall be manufactured from Class 35B gray iron, meeting the requirements of ASTM A48, *Standard Specification for Gray Iron Castings*. Standard manhole frames and covers shall be manufactured to the dimensions and configurations shown

on **Standard Detail 516.02** and shall be furnished with stainless steel, hex head cap screws and neoprene gasket. Minimum inside diameter of the opening shall be 24 inches. Manholes castings may be bituminous coated. The bearing surface of the frames and covers shall be machined and the cover shall seat firmly into the frame without rocking. Approved castings are Neenah R-1757-G Solid Lid with inner Liner, or approved equal. All castings are to be USA made.

2.3.9 PIPE SADDLE SUPPORT – ADJUSTABLE

Adjustable Pipe Saddle Support - For Dry Conditions 2½-inch through 36-inch pipe: Material to be cast iron saddle formed to ductile iron pipe, with lock nut, and special cast iron reducer. Vertical adjustment range to be from 0 up to 4½ inches. Adjustable pipe saddle supports shall comply with Federal Specification WW-H-171E (Type 39). Saddle strap to meet ASTM A36/A36M *Standard Specification for Carbon Structural Steel*. Collar and base cups ASTM A53 *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless* D.O.M. tubing. Thread Stud to meet ASTM A36/A36M, rolled thread, grade ASTM A307 *Standard Specification for Carbon Steel Bolts and Studs, 60,000-PSI Tensile Strength*. Base Plate to meet ASTM A36/A36M sheet steel, 0.25-inch. Pipe saddle supports shall equal or exceed the *Standon* Model S92, as manufactured by Material Resources, Inc., Hillsboro, OR., or Grinnell Figure 259.

Adjustable Pipe Saddle Support For Wet or harsh corrosive conditions 2-inch through 24-inch pipe: Material to be steel saddle formed to ductile iron pipe, lock nut, and special steel reducer. Vertical adjustment range to be from 0 up to 4½ inches. Material to be 100% 304 stainless steel with saddles formed of ductile iron pipe. Pipe saddle support shall equal or exceed the *Standon* Model S92 but all stainless steel, as manufactured by Material Resources, Inc., Hillsboro, OR., or approved equal.

2.3.10 SERVICES

A. Small Services: ¾-inch and 1-inch Water Services

Type K Copper; comply with ASTM B-88, *Standard Specification for Seamless Copper Water Tube*, FS WW-T-799 (2-inch and smaller pipe). Fittings to meet AWWA C800, *AWWA Standard for Underground Service Line Valves and Fittings*. On these water services, the fittings shall be flared copper type brass fittings at main and meters.

As an alternate to direct tap, a service saddle may also be used. Service saddles shall be painted ductile iron body with double steel U-bolts and a virgin NBR rubber gasket attached to the body. The saddle shall meet **Table 25.2** or an approved equal. See sheet 2 of **Standard Detail 515.01**. Corporation stops to be Ford F600 series or Mueller H-15000 series, or approved equal.

Table 25.2		
Manufacturer	Model (Single Strap) (4- & 6-inch mains)	Model (Double Strap) (8-inch and larger mains)
Ford	101B	202B
Mueller	BR1B	BR2B
Smith Blair	321 Series	323 Series

Meter setters shall consist of a meter iron yoke bar dual check valve adapter and angle ball valve with padlock wings as son on [Standard Detail 515.01](#). Meter an expansion wheel to be provided by the City of Fairfax. Metter setter components shall be comprised of the following:

Table 25.3		
Item	Manufacturer	Model
Yoke Bar	Mueller	¾" H-5020; 1" H-5040
Dual check valve/adapter	Mueller	
Angle Ball Valve with padlock wings	Mueller	
Expansion Wheel	-	Provided by City of Fairfax
Meter	-	Provided by City of Fairfax

B. 1 ½-inch and 2-inch Services

Water service pipe for 1½-inch and 2-inch connections shall be type type K soft copper; comply with ASTM B-88, *Standard Specification for Seamless Copper Water Tube*, FS WW-T-799 (2-inch and smaller pipe). On these water services, the fittings shall be flared copper type brass fittings from meter to main. The service saddle shall be painted ductile iron body with double steel U-bolts and a virgin NBR rubber gasket attached to the body. The saddle shall be Ford 202B, Mueller BR2B, Smith Blair 323 Series, or approved equal (see [Standard Detail 515.02](#)).

Meter Setters shall be constructed from 85-5-5-5 Brass (AWWA C800, *AWWA Standard for Underground Service Line Valves and Fittings*) and copper tubing, and factory tested for water-tightness before shipping. Setter to include ball valves, brace pipe eyelets for 1 inch pipe, and bypass valve with padlock wings.

The Setter assembly shall conform to [Standard Detail 515.02](#). Approved Manufacturers and models meeting the above specifications are:

Table 25.4		
Flanged Copper Meter Setters with Ball Valve Inlet		
Size (inches)	Ford	Mueller
1 1/2	VBB76-15B-111-66	B-2423-2 / B-2423-2 6A
2	VBB77-15B-11-77	B-2423-2 / B-2423-2 6A

C. Meters – (all meters)

Meters up through 2 inches are to be provided by the City of Fairfax shall meet AWWA C700, *AWWA Standard for Cold-Water Meters-Displacement Type, Bronze Main Case* [or, [AWWA C701, AWWA Standard of Cold-Water Meters-Turbine Type for Customer service](#)]. Large meters (2-inch through 6-inch) shall be compound meters and shall meet AWWA C702, *AWWA Standard for Cold-Water Meters-Compound Type*. All meters shall read in cubic feet.

Table 25.5 AWWA C702 Compound Meters	
Meter Size (inches)	Neptune
2 thru 6	TRU/FLO Compound

D. Large Services

For services greater than 2 inches, the water service pipe shall be ductile iron pipe. Ductile iron fittings shall be used on these services. All taps will be made by using the appropriate size tapping sleeve and valve. On a dry line, the connection may be made with a tee and valve.

2.3.11 VALVE BOXES

Adjustable valve boxes shall be asphalt coated US made gray cast iron of the dimensions shown in [Standard Detail 513.02](#). Lids shall have the word “WATER” or “W” cast into the lid. Provide cast-iron telescoping top section of length required for depth of burial of valve and bottom section with base of size to fit over valve. Valve box and lid shall equal or exceed that as manufactured by Capitol Foundry model VB-FCWA, pattern number 3435.

2.3.12 SMALL WATER METER BOXES - NON-TRAFFIC BEARING

17 inch x 11 ¾ inch x 18 1/8 inch deep HDPE structural foam water meter boxes for non-vehicular traffic situations shall be as manufactured by Carson Industries, Glendora, CA, model 1419-18-4 (T-cover) or approved equal. Box is to be set on two rows of solid brick. See [Standard Detail 515.01](#). Water meter boxes are to be furnished by the City of Fairfax.

2.3.13 1 ½ INCH AND 2 INCH METER BOXES

PVC meter boxes, shall be as manufactured by Oldcastle Precast, model 0036. Meter cover shall be A. Y. McDonald model 74ML20 with model 74MF1020 monitor flange and model 74MR1000 ring. Meter box, frame, and cover are to be furnished by the City of Fairfax.

2.3.14 VAULT ACCESS HATCH

A. Non-Traffic Areas

The aluminum access frames and covers are manufactured with 1/4-inch thick, one-piece aluminum extruded frame, with a continuous concrete anchor as part of the one-piece extrusion. The door panels are 1/4-inch thick aluminum diamond plates, to withstand a live load of 150 lbs. per square foot, with a safety factor of 3.0. The doors are provided with stainless steel hinges with tamper-proof fasteners. All hardware is stainless steel. The doors open to 90 degrees and lock automatically in that position with a stainless steel positive locking arm and a stainless steel release handle. Doors are provided with a stainless steel lifting handle, stainless steel locking bar, or stainless steel snap-lock with removable key handle. Two key handles shall be provided with each door. The doors will close flush with the top of the frame, resting on a 1/2-inch wide lip around the entire inside of the frame for added support.

B. Traffic Areas (Low Density Traffic H-20 Loading – 12,000 lb. wheel load on an 8 1/2-inch x 20 1/2-inch wheel area)

The aluminum access frames and covers are provided with a 1/4-inch thick structural grade aluminum channel frame with the flanges acting as a continuous concrete anchor. The inside of the frame has a continuous door support angle that must be cast into the top slab of the vault. Door leaves shall be a minimum of 1/4-inch thick aluminum diamond plate with structural grade aluminum. Door reinforcing shall withstand an H-20 live load designation. The doors also have lifting aids of aluminum tubular construction with compression springs to assist in opening and closing of the doors. The doors are provided with heavy-duty stainless steel hinges with tamper-proof fasteners. All hardware is to be stainless steel. The doors open to 90 degrees and lock automatically in that position with a stainless steel positive locking arm and a stainless steel release handle. Doors are provided with a stainless steel lifting handle, stainless steel snap-lock with removable key handle. Two key handles shall be provided with each door. The door leaves extend to the outside perimeter of the frame for added support.

C. Guarantee and Manufacturer

The aluminum access frames and covers shall carry a 10-year guarantee against defects in materials and workmanship. The frame and cover shall equal or exceed the units manufactured by the Bilco Company, Halliday Products, Inc., or an approved equal.

2.3.15 DETECTOR TAPE

Non-metallic underground warning tape: Non-metallic underground warning tape shall be lead free virgin grade rot resistant polyethylene manufactured in accordance with ESI 12-23. Minimum elongation shall be 350% in the machine direction and 300% in the transverse direction. Soil tolerance range to be pH 2.5 to pH 11.0. Minimum tape thickness shall be 0.1mm with a base color of blue. Minimum width to be 2 inches. The text shall include the wording "CAUTION WATER LINE BELOW" repeated along the length of the tape. Underground warning tape is to be placed 24 inches below the finished grade, but no less than 24" above water lines during backfill procedure.

PART 3 – EXECUTION

3.1 PIPE AND FITTINGS

3.1.1 DUCTILE IRON PIPE

Construction: Water mains and fittings shall be installed with approved tools in accordance with the requirements of AWWA C600, *AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances*, and any special applicable supplementary instructions issued by the manufacturers of the equipment being installed, which is made a part of this specification by reference. Pertinent parts of AWWA C600 shall also be applicable along with the manufacturers' instructions for installation of Prestressed Concrete Pressure Pipe, copper pipe, or other pipe material specified by the City.

Construct piping to accurate lines and grades avoiding localized high points and support as required on drawings or described in specifications.

No more than 500 feet of trench is to be open at any time.

Due care shall be taken in the storing and handling of pipes, fittings and valves to avoid contamination with the ground and prevent foreign matter from entering pipe and fittings.

Pipe, fittings, and valves shall be carefully handled and lowered into the trench. Under no circumstances shall any pipe or fitting be dumped or rolled into the trench, or be allowed to drop against the pipe or fitting already in the trench. Great care shall be taken to prevent the pipe lining and coating from being damaged, and the Contractor shall not install any damaged pipe. The Contractor shall be responsible for removal and disposal of damaged pipe.

The Contractor shall be required at the end of the day's work to keep the end of the line, under construction, plugged to prevent foreign matter from entering pipe and fittings.

Special care shall be taken to insure that the pipe is well bedded on a solid foundation, and any defects due to settlement shall be made good by the Contractor at his own expense. Bell holes shall be dug sufficiently large to insure the making of proper joints. Special precautions shall be exercised to prevent any pipe from resting on rock. A minimum of 6 inches is required between rock and the bottom of pipe.

Whenever a pipe requires cutting, to fit in the line or to bring it to the required location, the work shall be done in a satisfactory manner with an approved cutting tool or tools which will leave a smooth end at right angles to the axis of the pipe and not otherwise damage the pipe or liner. When the cut end is to be assembled in a bell, an adequately smooth (without sharp edges) bevel should be ground or filed on the cut edge to prevent damage to or dislodgement of the gasket during assembly. The methods of cutting pipe shall be in accordance with Manufacturer's recommendations. No welding, flame cutting or flame tapping will be allowed. Such cuts shall be made by the Contractor without extra compensation.

Mains shall be installed to the depth as indicated on the plans, but in no case with a cover of less than 36 inches below finished grade for mains 12 inches and smaller and 48 inches below finished grade for mains 16 inches and larger, as shown on [Standard Detail 512.02](#). In the event site conditions prevent adherence to minimum cover requirements, approval of an alternate cover depth by Utilities Engineer is required.

Maximum horizontal deflections for ductile iron pipe shall meet AWWA C600, latest revision.

Allowable Joint Deflection			
Size (inches)	Nominal Laying Length (feet)	Maximum Allowable Deflection	
		Offset per Length (inches)	Deflection Angle (degrees/radius,ft)
4	18	19	5°/205
6	18	19	5°/205
8	18	19	5°/205
12	18	19	5°/205
16	18	11	3°/340
20	18	11	3°/340
24	18	11	3°/340
30	18	11	3°/340
36	18	11	3°/340
42	18	11	3°/340
48	20	12	3°/380

A 2-inch detectable marking tape (approved by the Utilities Engineer) shall be placed 2 feet above all water mains. See [paragraph 2.3.15, Detector Tape](#).

Not more than 2,000 feet of water main shall be installed without testing and sterilization in accordance with [paragraph 3.5, Testing and Disinfection](#) of this specification. Contractor shall not proceed with construction until the preceding water main section has been accepted by the Department of Utilities.

A. Installing Mechanical Joint Pipe

- 1) Clean socket and plain end thoroughly, removing mud, oil, gravel, or any other foreign matter. Gaskets shall be lubricated. Paint the bell and the spigot with soap solution (half cup granulated soap dissolved in 1 gallon of water). Slip ductile iron gland on spigot end with the lip extension of the gland toward the end of the pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.
- 2) Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts, and screw nuts up finger tight. Then tight all nuts to torque listed below (excerpted from Table 2 of AWWA C600-99):

Bolt Size (Inches)	Torque (Ft. – Lbs)
5/8	45-60
3/4	75-90
1	100-120
1 1/4	120-150

Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.

- 3) Permissible deflection in mechanical joint pipe shall not be greater than listed in Table 4 of AWWA C600-99.

Allowable Joint Deflection			
Size (inches)	Nominal Laying Length (feet)	Maximum Allowable Deflection	
		Offset per Length (inches)	Deflection Angle (degrees/radius,ft)
4	18	31	8°-18'/125
6	18	27	7°-07'/145
8	18	20	5°-21'/195
12	18	20	5°-21'/195
16	18	13.5	3°-35'/285
20	18	11	3°-00'/340
24	18	9	2°-23'/450

4) Restrained joint pipe shall be installed per Manufacturer's recommendations.

B. Installing Push On Pipe

Clean the socket and 8 inches of the outside of the plain end thoroughly, removing mud, gravel, or any other matter that might cause the front of the gasket to protrude into the path of the entering spigot. Gaskets shall be lubricated. Flex rubber gasket and apply lubricant supplied with the pipe to the plain end and to the inside surface of the gasket before assembly. Insert gasket fully in the gasket recess of the socket, large end of the gasket entering first. For assurance of proper gasket positioning, a thin automotive, blade-type feeler gauge can be used for quick and easy probing to confirm a properly installed gasket position around the joint. Start the spigot end of the pipe in to the socket with care. The circumferential stripe on the plain end provides a visual indication for checking the proper insertion of the joint. Homing of the joint shall be done with a forked tool or jack-type device.

Restrained joint pipe shall be installed per Manufacturer's recommendations.

3.1.2 PRESTRESSED CONCRETE PRESSURE PIPE

A. Laying PCPP:

The pipes shall be carefully lowered into the trench by crane or other approved means. Pipe support for pipe shall provide uniform bearing for the pipe barrel along its entire length. Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gasket shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. The pipe is then forced "home." Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gage supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. In its final position, the joint between the pipe shall not be deflected more than one half inch at any point.

When the pipe has been joined, a band of least 5 ½ inches wide shall be paled around the outside of the pie at the joint as recommended by and available for the pie manufacturer. This band shall serve as a form for placing a 1:2 cement mortar grout in the external recess formed by the face of the bell and the shoulder of the spigot. If a reinforced paper joint band is used, it shall be drawn

up tight around the pipe and the backfill tamped against it up to the spring line before pouring the grout. If a cloth band is used, it shall be wired around the outside of the pipe and grout poured before backfilling. On pipes 24 inches or larger, the joint space remaining on the inside of the pipe shall be filled with a stiff mix of 1:2 cement mortar, which shall be trowled in place to produce a continuous, smooth, flush surface across the joint.

B. Anchorage and Encasement

The Contractor shall furnish and place all concrete anchorage and encasements, as called for on the drawings. Anchorage and encasements shall be considered incidental to the construction of the line.

C. Pipes of Special Lengths

Pipes of varying lengths, or other approved means of adjusting length of line as laid shall be provided to the end that each element of the mains shall be placed at the locations shown on the drawings. Such number of approved closure sections shall be provided as may be required in the course of the work.

The design and manufacture of pipe specials and fittings shall be AWWA C301 Type A such as to produce specials and fittings having strength and durability comparable with the pipe itself and suitable for the same service. Details of all proposed specials and fittings, including pipe with outlets, special joints details, reducers, ends, adapters, closure sections, boiler type manholes in pipe, air vent outlets, caps and plugs, shall be submitted to the Utilities Engineer for approval before they are manufactured.

- D. **Minimum pipe bedding class:** See [Section 02275 – Trenching, Backfilling and Compaction of Utilities](#), for minimum bedding requirements.

- E. **Bury Limitations:** Pipe shall be designed in accordance with AWWA C304, AWWA Standard for Design of Prestressed Concrete Cylinder Pipe. Bury limitations shall be as shown on the contract drawings and as specified by the Utilities Engineer and Pipe Manufacturer. Minimum bury shall conform to **Table 25.6**.

3.2 CONSTRUCTION

3.2.1 MINIMUM WATER PIPE BURY

Pipe shall be buried no less than indicated in [Table 25.6](#) except that at obstructions which cannot be relocated or modified, the cover may be reduced as necessary for short lengths (10 to 20 feet) to pass over said obstruction using 3 flexible joints in the offset within a length of approximately 8 feet, but in no case shall depth of cover be less than 36 inches. Approved bedding material shall be used wherever cover is less than 36 inches and shall completely encase pipe. No tees, valves, or house service corporation cocks shall be installed in mains with less than 36 inches of cover.

Where depth of cover would be less than 36 inches from top of pipe at obstruction, the water mains shall pass under the obstruction, clearing the obstruction by at least 12 inches and shall be completely encased up to the

bottom of the obstruction in concrete with no less than 6 inches of concrete on bottom and sides.

Table 25.6	
Minimum Water Pipe Bury	
Main Size	Minimum Bury (from top of pipe to finished ground surface grade)
Mains < 16 inches	48 inches
> 16 inches	54 inches

3.2.2 CUTTING PAVEMENT/DRIVEWAYS

Where the water line is in an existing paved area, the edges of the pavement for the water line shall be cut in a straight line, parallel to the pipe on each side. Trenches cut in existing or proposed pavement areas shall not exceed a maximum width of 3'-6" at the top of the trench. Perform cutting operations prior to installation of water line to avoid excessive removal of asphalt. Care shall also be taken during installation of pipe to avoid damage to adjoining paved surfaces. Refer to the applicable Municipal or VDOT standard pavement repair details pavement width and patching requirements. Driveway crossings shall be completed within 48 hours after the initial cutting of the pavement.

3.2.3 PROTECTION OF PAVEMENT

Whenever the water line is to be placed in or near a paved street, the Contractor shall provide pads or take necessary precautions to protect the pavement from damage by construction equipment. Pavement damage by cleats or tracked equipment, or by any other means, shall be repaired by the contractor.

3.2.4 UTILITY PROTECTION

Take necessary precautions to protect existing utilities from damage due to any construction activity. The contractor shall locate existing utilities, culverts, and structures (above or below ground), before any excavation starts and coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. Omission from or inclusion of located utility items on plans does not constitute non-existent or definite location. Secure and examine local utility surveyor records for available location data including building service lines. Contact underground damage protection services at least 48 hours before you dig.

The contractor shall protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on drawings or when locations differ from those shown on drawings, notify Project Engineer for instruction before proceeding. In the event that a gas line, water line, power cable or conduit, or telephone cable or conduit is broken or damaged, the contractor shall give immediate notice to the proper authorities and shall be responsible for any damage to persons or property caused by such breaks. If a service pipe supplying water or gas to an adjoining house is broken, the Contractor shall repair same at once. The City of Fairfax may, at the Contractor's expense, repair any such service without prior notice to Contractor.

Should it become necessary to move the position of any underground structure, the Contractor may be required to do such work.

The Contractor shall be responsible for protecting all existing utilities that could be damaged by excavation near the proposed line. Trench boxes may be necessary to prevent sloughing, etc., as well as to protect workmen, the motoring public, and the pavement. Failure to use a box, which subsequently results in damage to an existing line or other public improvements, shall be cause for liability against the Contractor for the repair costs.

3.2.5 SURFACE OR GROUND WATER IN TRENCHES/PIPE

When ground water is encountered, the Contractor shall pump, or otherwise remove any water that accumulates in the trenches and shall perform all work necessary to keep the trenches clear from water while pipe is being laid. No pipe shall be constructed in water and water shall not be allowed to drain through the pipe. At the end of the day, the open end of the pipe shall be kept closed by placing a watertight fitting plug into the bell end to prevent washing of any foreign matter into the line. All water removed from the trench shall be conveyed in a proper manner to a suitable point of discharge and shall comply with the applicable erosion and sedimentation laws. See also, [*Dewatering of Section 02275 – Trenching, Backfilling, and Compaction of Utilities*](#).

3.2.6 ABANDONING OF EXISTING WATER SERVICES/MAINS

Removal of Lines from Service: When an existing water line is replaced with a new water line, the Contractor shall remove abandoned lines from active service upon completion of replacement line, and/or after transfer of service to a replacement line. Location of abandonment shall be approved by the City's representative.

Services: When abandoning services 2-inch or less in diameter, the line shall be cut at the corporation stop on the main or as close to the main as possible and a one-foot segment of the line removed. Under circumstances where the line to be abandoned is 2 inches or less in diameter and threaded galvanized pipe is screwed into a mechanical joint plug, the line may be deleted from active service through removal of the galvanized line from the mechanical joint plug and replaced with a threaded brass plug. All plastic fittings shall be replaced with ductile iron or other fittings approved by the Utilities Engineer.

Mains: All mains are to be abandoned at source, valve removed, and the "tee" or tapping sleeve plugged with a mechanical plug. Under circumstances where the line to be abandoned is connected to a lead joint cross or tee, the section of line being intercepted which contains the lead joint cross or tee shall be replaced with mechanical joint fittings or straight pipe using mechanical joint sleeves. All water control devices to be abandoned shall be closed and valve boxes removed to 18 inches below the surface.

In either situation, if a water control device is not located at the source, plugging of the branch at the source will be required.

3.2.7 CONNECTIONS TO EXISTING MAINS

The Contractor shall furnish all materials for connection to existing water mains where shown on the plans or as directed by the Utilities Engineer.

In making connections to the existing distribution system, valves shall be set as shown on the plans or at such locations as directed by the Utilities Engineer.

Request for operations of valves shall be made to the Utilities Division. See paragraph [1.10. Coordination](#), above.

Department of Utilities' staff shall be the sole operator of all valves and fire hydrants.

If the connection to the existing mains requires a wet tap, such tap shall be done by a firm experienced and equipped to do this type of work and only with the approval of the Department of Utilities. "Same size" wet taps will not be permitted. All materials and labor shall be provided by the Contractor to include, but not necessary limited to the sleeve, valve, tapping machine, accessories, installation, and testing of such materials to complete the work. For all water mains up to 16 inches in diameter, wet taps shall be made using a tapping sleeve. For water mains 16-inch diameter and larger, a tapping saddle is acceptable. The Utilities Engineer shall have the right to accept or reject the firm or crew performing the work. The sleeve and valve assemblies shall be tested in accordance with the applicable sections of paragraph 3.9 for 10 minutes before the actual tap is made.

Work shall be scheduled at least 5 working days in advance and a crewman from the City Inspector shall be present during the operation.

3.2.8 STEEL ENCASEMENT PIPE

- A. **General:** Where required, steel encasement pipe shall meet the length, thickness, and diameter as shown on the plans. A Steel casing shall be installed under the pavement or rail as indicated on the drawings by jacking, boring, or open cuts method. The encasement shall be located in an area that is relatively free from material such as rock and stone that may hamper the boring operation.

Construction shall be executed in such a manner as to prevent settlement of the ground surface above the pipeline. The installation of the pipeline shall follow the heading or tunneling excavation as closely as possible.

All operations of the Contractor shall be subordinate to the free and unobstructed use of the right of way of the passage of traffic without delay or danger to life, equipment, or property. Installation shall be in accordance with Section 302.03 of the *VDOT Road and Bridge Specifications* or AREA, as applicable and *VDOT Standard Detail 1404.01*.

The pipe shall be beveled and prepared for field welding at the circumferential joints. Joining of steel casing pipe shall meet the requirements of AWWA C206, *Standards for Field Welding Steel Water Pipe Joints*.

Casings shall be installed on slope to permit draining. Encasement ends shall be enclosed.

- B. **Spiders/Skids:** Spiders shall be placed at the bell of each carrier pipe within a steel encasement as well as at each end of the steel encasement pipe. For bolted connections, bolts shall be either galvanized or stainless steel. See [paragraph 2.1.4, Steel Casing Pipe](#), paragraph B.

3.2.9 TUNNELING METHOD

A. GENERAL

- 1) The Contractor shall submit shop drawings to the Utilities Engineer for approval prior to construction. All liner plates and ribs used in the tunnel shall be of one type. All material removed shall be disposed of off the site by the Contractor. Casings shall be installed on slope to permit draining.
- 2) All operations of the Contractor shall be subordinate to the free and unobstructed use of the rights of way for passage of traffic without delay or danger to life, equipment, or property. The Contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times. The Contractor shall provide all traffic control devices as necessary and as shown on the approved traffic control plan at no additional cost.

B. TUNNELING (BORING METHOD)

- 1) Commence boring operation from a pit, with the bottom excavated to grade, and sheeted or shored if necessary. A steel pipe shall be jacked in place as a casing pipe.
- 2) After installation of the casing pipe, pull the carrier pipe in place a joint at a time. Each section of carrier pipe shall be supported by steel spiders strapped to the carrier pipe.
- 3) Close up tunnel liner ends to protect against entrance or foreign matter. The open ends of the casing pipe or tunnel shall be closed off by an 8-inch grout or masonry block wall prior to backfilling. A steel drain line to a 1 cubic yard French drain or daylight shall be provided.

C. TUNNELING (HAND MINING)

- 1) Commence tunneling operation from a pit, with the bottom excavated to grade, and sheeted or shored if necessary.
- 2) Trim the periphery of the tunnel smoothly to fit the outside of the steel liner plate as nearly as practical.
- 3) Install the steel liner plates immediately after the excavated material has been removed, and remove the material not more than 24 inches ahead of the installed liner plates.
- 4) Grout all voids between the soil and tunnel liner plates. The maximum grouting pressure shall be 30 PSI. Start grouting at the bottom of the tunnel

liner plates and proceed upward progressively and simultaneously on both sides of the tunnel. Install liner plates no more than 6 feet ahead of grouted section. Prohibit traffic over ungrouted sections of tunnel unless this section is in solid rock. Thoroughly dry-mix grout ingredients before adding water. After adding water, mix the batch for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. Placing shall be quick and continuous. Placement shall be under pressure with a grout pump. The period between installation of the tunnel liner plate and the placing of grout shall not exceed 7 hours, without the approval of the Utilities Engineer. Upon completion of grouting, fill grout plugs with provided grout hole plugs.

- 5) Smoothly pave the bottom of the tunnel with concrete: After installation of the tunnel liner plates, the Contractor shall pour concrete pavement on the bottom quadrant (invert) of the tunnel, the surface of the pavement being parallel to the inner plate, with screed rails embedded in it, on line and grade for the installation of pipe in the tunnel.
- 6) The periphery of the tunnel shall be trimmed smooth to fit the outside of the steel liner plate as nearly as is practical, so that the void outside the plates is a minimum.
- 7) After installation of the tunnel liner, pull the carrier pipe in place a joint at a time. Securely block each section in place. Each joint of the carrier pipe shall be supported at two points by spiders or skids, strapped to the carrier pipe. The carrier pipe shall be blocked, in place to the prevent flotation.
- 8) Close up tunnel liner ends to protect against entrance or foreign matter. The open ends of the casing pipe or tunnel shall be closed off by an 8-inch grout or masonry block wall prior to backfilling. A steel drain line to a 1 cubic yard French drain or daylight shall be provided.
- 9) If installation is under railway tracks, all permits shall be obtained and Railway Company shall be notified prior to such installation. The same shall apply to contacting the City of Fairfax if installation is under roadway.

D. See also PART 2 – PRODUCTS, [Section 2.1.5, Tunnel Liners and Appurtenances.](#)

3.2.10PVC PIPE

C900 PVC pipe shall only be used with written approval from the Utilities Engineer.

3.3 VALVES AND FIRE HYDRANTS

3.3.1 GENERAL: All water main fittings shall be restrained mechanical joint. All bends and elbows of 3 inches or larger shall be installed with a concrete thrust blocks poured in place with the concrete deposited against firm undisturbed earth.

3.3.2 Valve Applications

A. **Valves – Above ground applications** (in vaults or buildings):

- | | |
|-------------------------------------|---|
| 1) 2-inch and smaller: | Bronze ¼ turn ball type |
| 2) 4-inch and larger: | OS & Y Gate Valves |
| 3) Relief Valves: | Air Release Valves |
| 4) Water-Regulating Valves: | Pressure-regulating valves
Flow-regulating valves |
| 5) Detection of unauthorized water: | Detector Check Valves |
| 6) Backflow prevention: | Reduced Pressure Zone Backflow
Preventers – USC approved
Double Check Valve Assemblies –
UL/FM rated |

B. **Valves – below ground applications:** Non-rising stem.

3.3.3 GATE VALVES

- A. **Setting of valves and valve boxes:** Valves shall be installed with stems in a vertical plane through the pipe axis and perpendicular to the pipe axis. The Contractor shall clean the valves before installation and check for satisfactory operation. All valves adjacent to tees or bends shall be tied to the fitting with Megalug joint restraint. Valve nut extensions shall not be installed unless approved by the Utilities Engineer.

Nipples for 6-inch through 12-inch valves shall be cut so that the valves are installed no more than 4 feet from the fitting (centerline to centerline). 2-inch valves shall be installed with a 4-inch long brass nipple.

- B. All underground valves without gearing or operators shall be installed with a 2-piece valve box with lid (see **Standard Detail 513.02**). Valve boxes shall be centered with the valve nut. Valve box cover must be set flush with the finished ground surface or pavement. Valve boxes shall be set in a manner to prevent transmitting shock or stress to the valve with stone around pipe and under valve box. The Contractor shall be responsible for keeping valve boxes clean and free of any foreign matter until acceptance of the project.
- C. **Valve Box Adjustment:** The Contractor shall adjust valve boxes to final grade at the time designated by the Utilities Engineer.
- D. **Valve Box Stabilizing Pad:** All valve boxes located outside the pavement shall be set to grade and a precast reinforced concrete shoulder slab shall be installed. See **Standard Detail 513.05**. No extra payment will be made for this item.
- E. **Valve Box Removal:** When shown on the drawings or directed by the Public Services Director, the Contractor shall remove existing valve box(es), place select fill, stone or other material and repair pavement. Salvaged valve box(es) are to be delivered to the Property Yard at 3410 Pickett Road, Fairfax, VA 22031.

- F. When valve box tops project more than 1 inch above the unfinished road surface, a temporary layer of asphaltic concrete feathering shall be required to provide a smooth transition from 1 inch below the edge of the rim and cover to the unfinished road surface. The exposed sides of the valve box shall be painted bright orange.

3.3.4 VALVES 16 INCHES AND LARGER (GATE OR BUTTERFLY VALVES)

Valves with gearing or operators shall be installed in a manhole. The manhole shall be constructed/set in such a way as to prevent transmitting any load or shock to the valve. It is also to be set in such a way that the packing, operator, and other parts of valve are readily accessible for minor repairs. The valve is to be provided with a flanged coupling adapter to permit valve removal for maintenance. Manhole opening shall be positioned over the operating nut. Valve to be coated. Either a gate valve or a butterfly valve may be used.

3.3.5 TAPPING SLEEVES AND VALVES

Wet taps shall employ a ductile iron mechanical joint sleeve, or other fitting specifically designed for this purpose as approved by the Utilities Engineer. For all water mains up to 16 inches in diameter, wet taps shall be made using a tapping sleeve. For mains 16 inches and larger a tapping saddle is acceptable.

A tapping sleeve and valve shall be installed in accordance with the manufacturer's recommendations at locations as shown on plans. After installation of the tapping sleeve and valve and prior to performing the tap, the assembly shall be hydrostatically tested at a pressure equal to the test pressure of the new line installed. Such pressure shall be maintained with no loss for a minimum time of 10 minutes.

Contractor is responsible for traffic control, excavating, dewatering, and safe access in the trench at the time of tap. The Contractor is to provide tapping sleeve and valve. Contractor must have approved traffic control plan.

3.3.6 AIR RELEASE VALVES

Air release valves are to be used to bleed air during filling of a water line and to automatically vent air that collects in the water lines. Pressure air release valves shall be located as shown on the drawings. The valve shall be housed in a precast concrete eccentric manhole and shall be installed in accordance with **Standard Details 513.04**. Air release valve locations shall be as shown on the plans and as otherwise directed by the Utilities Engineer.

Galvanized steel fittings will not be accepted.

3.3.7 FIRE HYDRANTS

- A. Fire hydrant locations shall be as shown on the plans or as otherwise directed by the Fire Marshall. Hydrants shall be set upon VDOT #57 stone in such manner as to preclude the possibility of settlement of hydrants. Place ½ cubic yard VDOT #57 stone around the hydrant elbow, compact and separate with polyethylene as shown on **Standard Details 514.01, 514.02, and 514.03**.

Hydrants are to be located at a distance from the curb or edge of pavement to provide ready access and minimize the possibility of damage from vehicles and set to the height prescribed by [Standard Detail 514.01](#), [514.02](#), and [514.03](#) with the pumper nozzle facing or pointing to the street or fire access lane. Hydrants shall maintain a 5-foot horizontal separation from the edge of driveway aprons when possible. Hydrants must be set with the stem vertical/plumb and the flange above grade. Traffic model fire hydrants are to be installed such that the breakaway flange is not less than 2 inches or more than 6 inches above finished grade. The Contractor is responsible for determining barrel length and ordering to meet conditions.

Where adjustments in height are needed, extension kits shall be provided and installed. However, only one 24-inch riser extension is allowed per hydrant.

Where hydrants are set behind guardrails, the pumper nozzle shall be set with its centerline a minimum of 12 inches and a maximum of 18 inches above the top of the guardrail.

- B. Hydrants are to be restrained to the valve and the valve to the main with Megalug joint restraint where hydrant branches exceed 20 feet.
- C. **Operation and Painting:** Hydrants, upon installation and prior to acceptance of the project, shall be painted and greased, and individually operated in the presence of a City representative to verify the hydrant is wet. The paint shall consist of two additional coatings on top of the original coating provided by the hydrant manufacturer. See [paragraph 2.2.6.B](#), item 13 and [Standard Detail 514.01](#) for paint specification.
- D. Place a black plastic bag or an “*Out of Service*” ring around steamer nozzle of newly installed fire hydrant until hydrant is placed in service and accepted by the City.
- E. **Valving of Main:** A leg valve is required on all hydrant legs. Install hydrant valve as close to the main as possible. When valve is placed outside the pavement, provide a concrete stabilizing pad in accordance with [Standard Detail 513.05](#).
- F. Fire hydrants are to be pressure tested with the main.

3.3.8 BACKFLOW PREVENTERS

Refer to the City of Fairfax _____ (the title of your, for example, “*Water System Cross-Connection Control Ordinance*”), Article _____ of the City Code, latest revision for hazard classification and type backflow device requirements, which is herein made part of this specification by reference.

3.3.9 DOUBLE DETECTOR CHECK VALVES

Double Detector Check Valves shall be installed in the horizontal position with an arrow pointing in the direction of flow. The by-pass meter may be trimmed either right or left.

Double check valves may also be permitted in below ground vaults as long as test cocks are piped above ground.

3.4 MISCELLANEOUS APPURTENANCES

3.4.1 SERVICES

- A. **General:** All fees must be paid and work scheduled with the City of Fairfax Utilities Department before the tap can be made. All materials must be on-site, trenches open, and shoring and traffic control devices in-place before the tap is made. Contractor may be required to provide approved traffic control plan if require by inspector.
- B. Water service pipe for 3/4 through 2-inch connections shall be one continuous run from main to meter with no joints or couplings in between. On these water services, the fittings shall be flared type brass fittings. No soldering allowed.
- C. Copper service connections shall be installed so that the outlet is at an angle of 45 degrees above the horizontal. An S-bend or "gooseneck" in the service line shall be provided to insure flexibility. Corporation stops shall be placed in clean VDOT #57 stone is to be carried under and around the pipe to protect the corporation stop. Service saddles are also to be embedded in 1 cubic foot of VDOT #57 stone. If 2 taps are made on each side of the water main, there shall be a minimum of 18 inches of horizontal separation. Multiple taps on the same side shall have a minimum 18-inch horizontal separation and staggered a minimum of 1 inch vertically to prevent damage to the water main. Extend service 7 to 8 feet beyond the meter box, or whatever distance is necessary, to ensure clearance from under sidewalk and the end of the service either plugged or crimped.
- D. All services shall be pressure tested in conjunction with main.
- E. Service taps shall also be subject to the requirements of AWWA C600, *Installation of Ductile Iron Water Mains and their Appurtenances*, latest revision.
- F. Tapping of cast or ductile iron pipe shall be done in accordance with the recommendation of the tapping machine manufacturer. All services taps on the main greater than that allowed by pipe manufacturer for a direct tap shall have a saddle type corporation. All 2-inch taps on 6-inch or 8-inch mains shall require installation of a saddle. Corporation stop for direct taps may be used on ductile iron pipe and shall have AWWA Standard tapered threads. See [Standard Detail 515.02](#).
- G. **Tap Location:** No closer than 8 inches from end of pipe up to 16" diameter.
- H. Meter boxes shall be set on a minimum of 6 inches of clean VDOT #57 stone and 2 rows of solid brick. Meter boxes shall be installed on the right-of-way side at the property line. Meter shall be centered in the meter box and angle valve shall be operational with above ground key. See [Standard Detail 515.01](#) and [515.02](#).
- I. No sharp bend of the service line will be permitted. Where right angle installation is not feasible, such as at the end of cul-de-sacs, a tracer wire shall be installed. Installation of tracer wire shall be from the main line tracer wire to the meter box with sufficient excess length left in the meter box. Service lines shall not be located beneath driveways.

- J. Firm bedding with at least 18 inches of cover shall be provided from the corporation to near the meter setter.
- K. Backfill shall be free of rocks or large objects that could crimp or damage the line. Service line trenches in traffic areas shall be tamped to achieve 95% Standard Proctor Density. In landscaped areas, the surface shall be left smooth and uniform with the adjacent surface.
- L. If replacing an existing meter box, the Contractor shall transfer the old service into the back of the new service, complete in place to include removal and disposal of the old meter box and assembly. If meter box does not require tying into existing service, pigtail shall be crimped.
- M. Water services shall be abandoned by closing the corporation stop at the main and cutting out a section of the water service 1 foot from the corporation stop.
- N. Taps 4-inches and larger are to be made using a tapping sleeve or a fitting. For all water mains 4-inches up to 16 inches in diameter, taps shall be made using a tapping sleeve (wet tap) or a fitting. For mains 16 inches and larger a tapping saddle or is acceptable.

Service Connections on “In-Service” water mains.	
Size Connection	Responsibility
¾-inch through 2-inch services	Contractor makes tap and runs service line, sets setter (as applicable) and yoke bar, provides sets stone and brick, and meter box. City furnishes and sets meter and expansion wheel (where applicable).
3-inch and larger services	Contractor makes tap, runs service line, sets vault, and furnishes all material. City furnishes and installs meter.

- O. **Grounding to Water Services:** Grounding shall not be allowed to be connected to meter boxes or vaults. As a minimum, place meter boxes/vaults no closer than 10 feet from a building. If unavoidable, place a grounding jumper around meter box/vault.
- P. **Abandoning Water Services:** see paragraph [3.2.6 Abandoning of Existing Water Services/Mains](#).

3.4.2 RESTRAINTS/CONCRETE THRUST BLOCKING

- A. **Thrust Blocking:** Thrust Blocking must be installed at all fittings and changes in direction of the pipeline. Thrust blocks shall be constructed from 3000 psi concrete (at 28 days) and poured against an undisturbed earth trench wall. Concrete thrust blocking shall be constructed in accordance with **Standard Detail 512.01**. Sacrete is not permitted. Concrete anchors may be unformed but minimum dimensions must be maintained. All fittings and pipe shall be wrapped in plastic prior to installation of concrete to insure that bolts and nuts are free of concrete and debris to allow accessibility for future repairs.

Vertical upward thrust at fittings or vertically deflected joints shall be resisted with thrust collars of adequate size and weight to resist thrust. See **Standard Detail 512.05**.

Pipe manufacturer's installation manuals shall be followed for the anchoring of valves and fittings in difficult locations unless superseded by the requirements of these specifications.

Concrete thrust blocking is not recommended where the blocking may bear on other utilities or where the area behind the block may be excavated in the future.

A City representative must inspect all blocking and anchoring prior to backfilling.

- B. **Thrust Collars:** Thrust collars shall be constructed as shown in **Standard Detail 512.03** for pipes up through and including 36 inches in diameter. The thrust collar shall consist of a wedge action restrainer gland (see Section 2.1.1, paragraph B, item 3, *Mechanical Joint Restraints*, of this specification for manufacturer and model number of approved restrainer gland) placed around a joint of ductile iron pipe encased in a reinforced 3000-psi concrete block. Where the blocking provides thrust resistance for fittings, Megalug joint restraints shall be connected to the restraint flange fitting secured to a full joint of ductile iron pipe. On dead end lines, the thrust collars must be placed on a full joint of ductile iron pipe just after the terminal end line valve.

3.4.3 BLOW OFFS

See **Standard Detail 514.06**. Temporary blow off assembly shall include a 2-inch brass pipe riser with a 2-inch x 2 ½-inch increaser and a threaded nipple with National Standard threads for hose connection and valve box (see **Standard Detail 513.02**). Permanent blow offs shall conform to Standard Detail 514.07 for mains up to 24 inches and shall include a gate valve, valve box, a 2-inch brass pipe riser with a 2-inch x 2 ½-inch increaser and a threaded nipple with National Standard threads for hose connection and valve box.

3.4.4 VAULT CONSTRUCTION

Large Meter Vaults: Meter vaults for 3-inch and larger meters shall be placed level on a 6-inch bed of VDOT #57 stone that has been thoroughly and firmly consolidated. Meters and fittings shall be supported by pipe stands. Vault doors shall be centered over the meter and otherwise located as shown on **Standard Detail 515.04**.

During the contract, the Contractor may be required to perform vault related construction. Prior to performing such work, all materials, specifications, and additional costs (items not bid in other sections) shall be approved before commencing work. Vault Construction shall be in accordance with **Standard Details 515.04**.

3.4.5 MANHOLE INSTALLATIONS

Manhole bases shall be placed on two level 1'-10" wide x 6'-0" long x 10" reinforced concrete footings. The manhole shall be set to rest on the two footings and shall be constructed in accordance with **Standard Detail 513.04**.

A maximum of 2 grade rings or one grade ring and one course of concrete bricks will be allowed to bring the rim and cover to finished grade. If additional height is required, a riser must be installed. For air release manholes, flat tops shall be used.

Manhole rings and covers shall be installed a minimum of 12 inches above grade in easements with a concrete collar formed around the ring.

3.5 TESTING AND DISINFECTION

3.5.1 PREREQUISITE CONDITIONS FOR TESTING AND DISINFECTION

Pipelines shall be tested, in sections between valves, as soon as the installation is completed. Using this method, errors in workmanship can be identified immediately and leaks can be fixed quickly and with minimum expense. Prerequisite Conditions for Testing and Disinfection shall be as follows:

- A. Pipelines and appurtenances have been laid and the trench backfilled.
- B. Hydrants shall be properly located, operable and plumb and at correct elevation.
- C. Valves shall be properly located, operable and at correct elevation. Valve boxes or manholes shall be centered over operating nuts and the top of the box or manhole shall be at proper elevation.
- D. All services shall be installed.
- E. All reaction anchors have had sufficient set of 7 days or high early strength concrete, 3000 psi or greater, may be used to reduce the number of days required.
- F. Lines shall be properly vented where entrapped air is a consideration.
- G. All visible leaks, broken or cracked pipe, valves, hydrants, etc. shall be repaired in a manner approved by the Department of Utilities. Defective material shall be removed completely and replaced with new materials.
- H. Air release valves shall be installed complete and in place.
- I. All construction activities on the project, that requires trenching or excavation within the limits of the water location shall be completed.

3.5.2 ORDER OF OPERATIONS

- A. **Fill Line:** After all prerequisites are met, fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After filling, shut off system in order to prevent chlorinated water from flowing back in the line supplying the water.
- B. **Pressure Test:** A pressure test shall be scheduled with a City representative performing the test 48 hours in advance. Testing shall be in accordance with section [3.5.3, Pressure Tests & Leakage](#). If an existing gate valve is known to be leaking, chlorination must be performed prior to pressure testing.

- C. **Flushing:** Allow filled system to set undisturbed for a minimum of 24 hours, then begin flushing operations. Flushing shall be a velocity of not less than 2.5 feet per second and shall have a minimum turnover of 2 times the volume of the pipe being flushed through blowoffs and/or fire hydrants in accordance with AWWA C651, *AWWA Standard for Disinfecting Water Mains*. All water for main flushing will require a meter permit from the Utilities Department to measure the amount of water being used for billing purposes. Meter permits can be obtained through the Utilities Department by contacting 703.385.7920. In the event no meter is available when flushing is required, the volume of water used will be calculated by placing a pressure gauge on the flowing hydrant, recording the pressure, the flow nozzle opening diameter, and the duration of flow. The Contractor shall be responsible for making adequate provisions for drainage of flushing water, at his expense. Any damages that may occur from this operation shall be the sole responsibility of the Contractor. In conjunction with start of flushing operation, the City's representative will perform a high range chlorine concentration test. Chlorine concentration of 50 mg/l minimum must be provided. Allow chlorinated water to set in the test section for 24 hours after which the line shall be flushed and samples taken at various points. The chlorine concentration shall not drop below 20 ppm within a minimum period of 24 hours. [See Section 3.5.4, Disinfection and Bacteriological Testing.](#)
- D. **Sampling:** Check chlorine and turbidity. After allowing the system to flush until the chlorine concentration is less than 1 mg/l or no higher than that generally prevailing in the source system, the first bacteria sample shall be collected at regular intervals not exceeding 2,000 feet and tested for bacteriological quality. Corporation cocks shall be provided for sterilization at locations designated by the Department. The contractor shall be responsible for making adequate provisions for drainage of large volume of flushing water, including proper dechlorination/disposal of heavily chlorinated water. [See Section 3.5.4, Disinfection and Bacteriological Testing.](#)
- 1) Pipe subjected to contaminating materials shall be treated as directed by the City's representative. Should such treatment fail to cleanse the pipe, replacement shall be required. The City of Fairfax shall bear no portion of any cost sustained by the Contractor in meeting this specification.
 - 2) Services shall be included in the main line disinfection process. The contractor shall have the same responsibility for laterals as for the mains in regard to bearing full cost of any corrective measures needed to comply with either the bacteriological test or other such requirements.
 - 3) If the bacteria sample has passed, the system shall be left in service, provided a low range chlorine concentration test has been taken and approved by a City representative. The chlorine concentration shall be less than 0.1 mg/l (0.1 ppm) or no higher than that generally prevailing in the source system.
- Final:** After final flushing, flow all hydrants to confirm the valves are open.
- E. Provided that the bacteria sample has passed, a pressure test shall be scheduled with the City's representative performing the test 24 hours in advance. Testing shall be in accordance with [3.5.3, Pressure Tests & Leakage.](#)

3.5.3 PRESSURE TESTS & LEAKAGE

The Contractor shall test completed sections of water line, including service lines, fire hydrants, and fittings with water. This testing, however, does not relieve the Contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be done at the Contractor's expense. Testing shall be performed in the presence of the Utilities Engineer or his/her representative.

- A. **Pressure Test:** Subject the pipe system to a hydrostatic pressure test. Raise the pressure by pump to 150 psi, 150% of design working pressure, the maximum operating pressure for the locality as determined by the Department, or test pressure as shown on the drawings, whichever is greater. Measure pressure at the low point on the system compensating for gauge elevation. Maintain this pressure (+ or – 5psi) for 2 hours. If pressure cannot be maintained using reasonable pumping rate, determine cause, repair, and repeat the test until successful. Extreme care shall be used to prevent backflow into the potable water supply. The lines should be allowed to stand under pressure for a period of 24 hours prior to the test. Air should be vented from all high points just prior to the test. Only clean water, free of dirt and other debris, from a clean container shall be used for testing. The Contractor shall notify the Utilities Engineer at least 24 hours in advance of any expected test. The contractor shall pretest all mains for a period of 2 hours before notifying the City for a final pressure test. No final pressure test will begin after 2:00 PM. Contractor shall be responsible for all labor, materials, and equipment to perform the testing. Cost shall be included in other items bid.

Tapping sleeve and valve shall be hydrostatically tested in place prior to tapping of the existing line in accordance with the manufacturer's recommendations.

The City's inspector will verify 1 pressure test – the final observation of the test section.

- B. **Leakage Test:** During the pressure test, subject the system to a leakage test. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the test pressure, after all air in the pipeline has been expelled and the pipe has been tested for a duration of 2 hours. The maximum allowable leakage shall be no greater than allowances shown in Table 1 below (in accordance with Section 5.2, [Table 6A - Hydrostatic Testing](#) of AWWA C 600-93, *AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances*).

No leakage shall be allowed for services.

No leakage will be allowed for all welded steel pipe. If leaks are revealed by test, repair by rewelding. Peening of leaks will not be allowed. A certified welder must perform all welding.

If leakage exceeds allowances, the Contractor shall be responsible for locating, repairing leaks, and retesting of line until successful, at the Contractor's expense.

AWWA C600 TABLE 6A
ALLOWABLE PRESSURE TEST LEAKAGE
 (Allowable Leakage per 1000 ft. of Pipeline * in gph)
 (This table is excerpted from AWWA C600, Section 5.2, Table 6A)

AVG. TEST PRESSURE, PSI	NOMINAL PIPE DIAMETER-IN.																
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	0.26	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05
<p>* For pipe with 18 ft. nominal lengths. To obtain the recommended allowable leakage for pipe with 20 ft. nominal lengths, multiply the leakage calculated from the table by 0.9. If the pipeline under test contains sections of various diameter, the allowable leakage will be the sum of the computed leakage for each size.</p> <p>** This table is excerpted from AWWA C-600, Section 5.2 Table 6A</p>																	

3.5.4 DISINFECTION AND BACTERIOLOGICAL TESTING

Pipe Disinfection and Bacteriologic Testing: comply with AWWA C651, *AWWA Standard for Disinfecting Water Mains*. Bacteriological testing shall comply with Section 5 of AWWA C651. All samples shall be tested for bacteriological (chemical and physical) quality in accordance the *Standard Methods for the Examination of Water and Wastewater*; and shall show the absence of coliform organisms and the presence of chlorine residual. The lines shall not be placed in service or pressure tested until a negative bacteriological report has been received.

3.6 DECHLORINATION

Dechlorination of chlorinated water is required and is the responsibility of the Contractor and Owner of the project.

3.7 FINAL ACCEPTANCE

Upon completion of water main installations and prior to acceptance, the Contractor shall provide adequate and competent personnel to conduct, in conjunction with the City of Fairfax, an inspection of each valve and hydrant on the newly completed main. The purpose of this inspection shall be to insure the operability and location of each valve and to further insure that all valves are left in the open position.

3.8 CLEANUP AND RESTORATION OF SITE:

After the backfill is completed, the contractor shall dispose of all surplus material, dirt and rubbish from the site, and shall keep the site free of mud and dust to the satisfaction of the Utilities Engineer. Prior to completion of project, all dewatering “stingers” shall be removed and the void filled with either flowable fill concrete or VDOT #67 stone. The Contractor may be required to flush or sprinkle the street to prevent dust nuisance. It is important that clean up and restoration of the site follows the work closely. The contractor shall dispose of surplus material and clean the street at the end of each day for the portion of work completed that day unless additional cleaning is required. The Contractor is to ensure that all materials, vehicles, and equipment are not stored overnight within the City streets. After all work is completed, the contractor shall remove all tools and other equipment, leaving the site free, clean, and in good condition.

END OF SECTION 02510

[Back to top](#)

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